Volume 21 Study AFS 43-8

STATE OF ALASKA

Jay S. Hammond, Governor

Annual Performance Report for

# POND REARING OF CHINOOK AND COHO SALMON AND COHO BROOD STOCK DEVELOPMENT

by

Richard A. Marriott

ALASKA DEPARTMENT OF FISH AND GAME
Ronald O. Skoog, Commissioner

SPORT FISH DIVISION
Rupert E. Andrews, Director

TABLE OF CONTENTS

STUDY NO. AFS 43 MENDENHALL ANADROMOUS FISH REARING PONDS

Job No. AFS 43-8 Pond Rearing of Chinook and Coho Salmon and Coho Brood Stock Development
By: Richard A. Marriott



LIST OF FIGURES



LIST OF TABLES

RESEARCH PROJECT SEGMENT

| | | | |
|---|---|---|---|
| State: | ALASKA | Name: | Sport Fish Investigations of Alaska |
| Study No.: | AFS 43 | Study Title: | MENDENHALL ANADROMOUS FISH REARING PONDS |
| Job No.: | AFS 43-8 | Job Title: | Pond Rearing of Chinook and Coho Salmon and Coho Brood Stock Development |

Period Covered: July 1, 1979 to June 30, 1980

ABSTRACT

The 1979 experiments conducted at the Mendenhall Lakes Salmon Rearing Facility were designed to: (1) complete the evaluation of rearing chinook salmon, Oncorhynchus tshawytscha (Walbaum), and coho salmon, Oncorhynchus kisutch (Walbaum), previously released from the Mendenhall Lakes Salmon Rearing Facility; (2) compare return rates of estuarine pen-reared, and hatchery-reared coho smolts imprinted at the Mendenhall Facility; and (3) determine the most desirable brood stock of coho for use in improving the Juneau area marine sport fishery.

No salmonids were stocked at the facility in 1979, and no naturally-reared smolts were marked or enumerated. No eggs were taken from coho returning in 1979, as these stocks were not being continued at Crystal Lake Hatchery in an effort to eliminate bacterial kidney disease (BKD).

In 1978, 10,565 coho smolts were marked and released at the Mendenhall Facility holding pond from fish reared at the Fish Creek Estuarine Rearing Facility. Of the 68,034 Crystal Lake Hatchery reared coho smolts released at the Mendenhall Facility in 1978, 10,024 were marked and used as a control for the Fish Creek reared release.

Jack returns from these releases were enumerated at the facility in 1978. In 1979, adult returns from these releases were evaluated in the sport and commercial fisheries and as returns to the Mendenhall Facility. The release of Crystal Lake Hatchery stock performed better than the release of Fish Creek stock but not as well as fish marked from various natural systems in the area. Fish Creek stock coho released at Fritz Cove did no better than this stock released at the Mendenhall Facility, but because of the large number released, a calculated 72 appeared in the local sport fishery. The best performance was obtained from the Speel Lake stock, where 3.3 percent of the marked fish were recovered in the sport and commercial fisheries.

These fish were marked as pre-smolt fingerlings, and as such were expected to perform poorer than smolt marked releases. Timing of returns appeared similar to 1978, with the mean catch date of Mendenhall Facility releases falling between August 15 and August 18 and most tag recoveries occurring in the offshore power troll fleet.

## OBJECTIVES

1. To complete evaluation of rearing chinook and coho salmon previously released from the Mendenhall Facility.

2. To determine the most desirable brood stock of coho for use in improving the Juneau area marine sport fishery.

3. To determine feasibility of imprinting coho smolts to the Mendenhall Facility that have been reared in saltwater pens.

## BACKGROUND

A declining catch rate of salmon in the Juneau area sport fishery prompted the Sport Fish Division to study the feasibility of providing additional salmon for the fishery by pond-rearing salmon in existing lakes in the Mendenhall Valley north of Juneau. The project was first envisioned in 1968. The potential rearing lakes were situated on Forest Service land, so a cooperative agreement between the Department of Fish and Game and the U.S. Forest Service was written and the Mendenhall Salmon Rearing Facility was begun. Both agencies participated in the original planning and engineering of the facility. These plans called for the pond- rearing of chinook and coho fry to the smolt stage in three lakes. The location of the Mendenhall Facility is shown in Figures 1 and 2.

Scientific and common names of all species mentioned in this report are listed in Table 1.

Capital improvement construction began in 1972 and included dredging of one lake, constructing a holding pond, and dredging channels linking the lakes to a common outlet. Several dikes, concrete control structures, and two roads were also constructed, as shown in Figure 3. Salmon fry were first planted in Norton, Dredge and Moose lakes in 1973 (Tables 2 and 3).

During the first year of fish rearing operations (1973), effort was directed toward determining the feasibility of producing salmon smolts by pond-rearing methods in Norton, Dredge and Moose Lakes (Bethers, 1974). During summer months, rearing fish were fed two or three times daily with commercial dry fish food, and during winter months, the lakes were aerated to maintain dissolved oxygen levels.

During the first year of operation, engineering problems were encountered which precluded further use of Dredge and Norton Lakes for rearing. The outlet control structure and dikes at Dredge Lake were inadequate and frequent washouts allowed rearing fish to escape. For future use as a rearing lake, the inlet and outlet dikes and control structures would

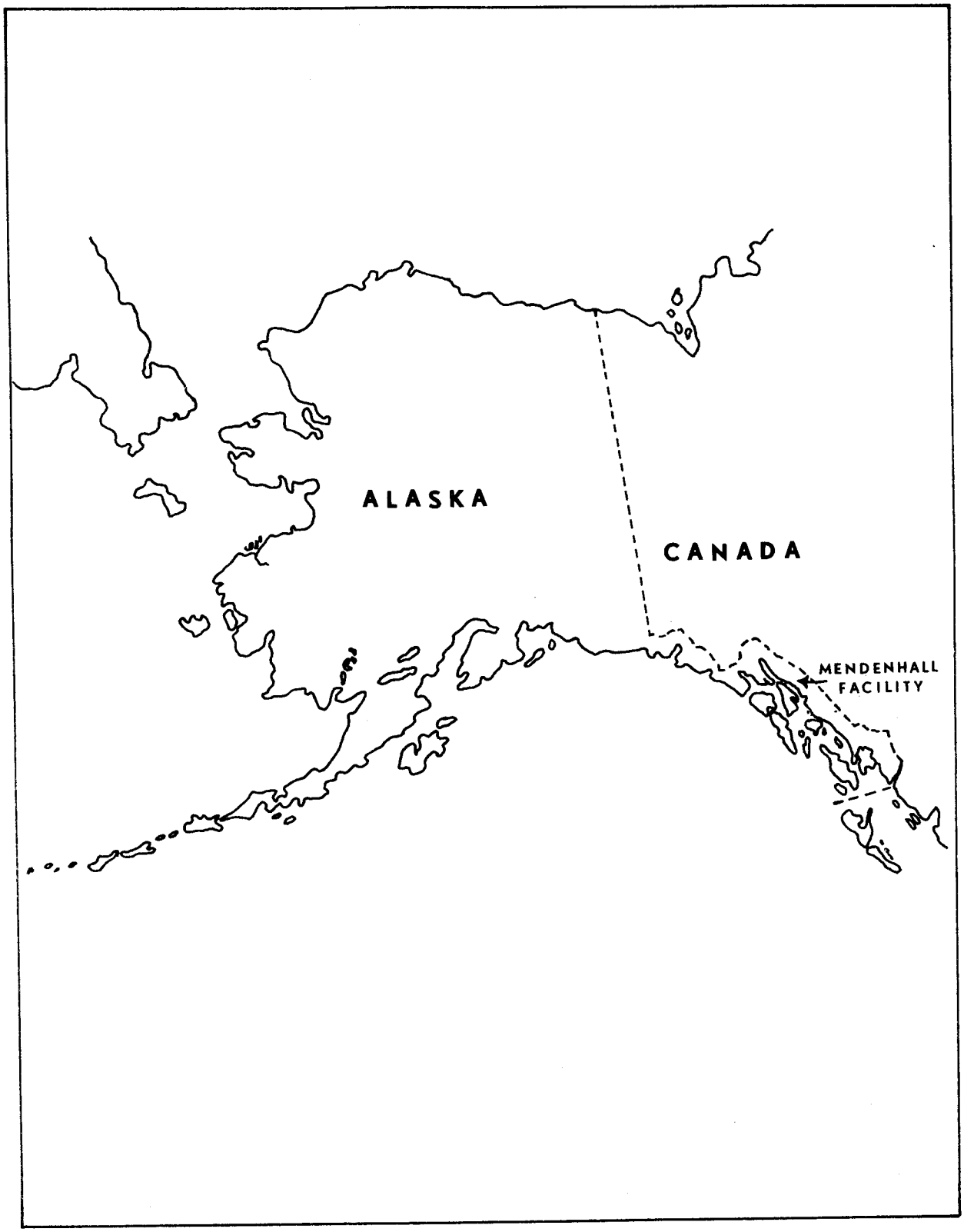



Figure 1. Location of the Study Area.

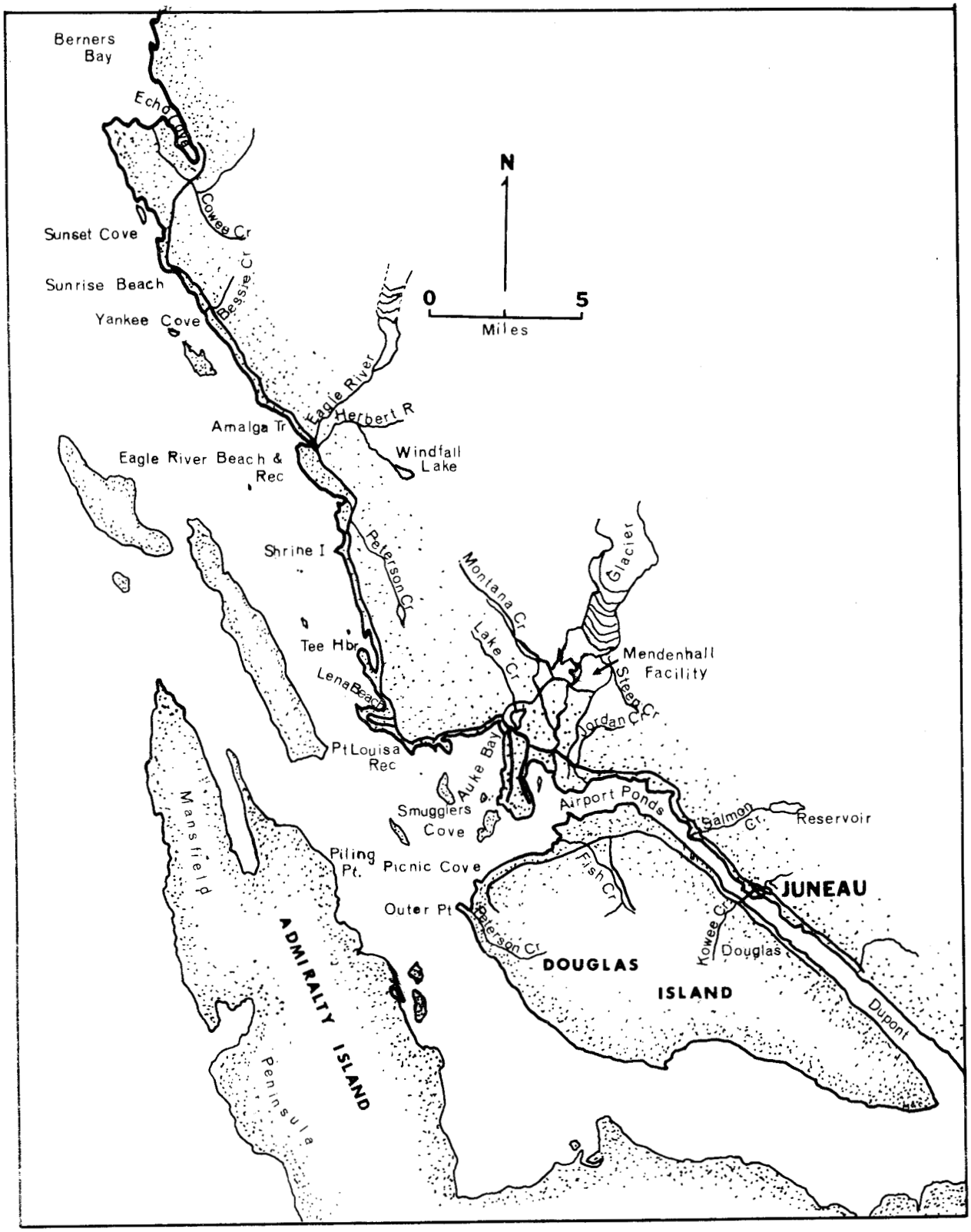



Figure 2. Map of the Juneau area roadside and marine recreational fisheries.

Table 1. List of Common Names and Scientific Names.

| Common Name | Scientific Name and Author |
|---|---|
| Chinook salmon | Oncorhynchus tshawytscha (Walbaum) |
| Coho salmon | Oncorhynchus kisutch (Walbaum) |
| Dolly Varden | Salvelinus malma (Walbaum) |
| Cutthroat trout | Salmo clarki Richardson |

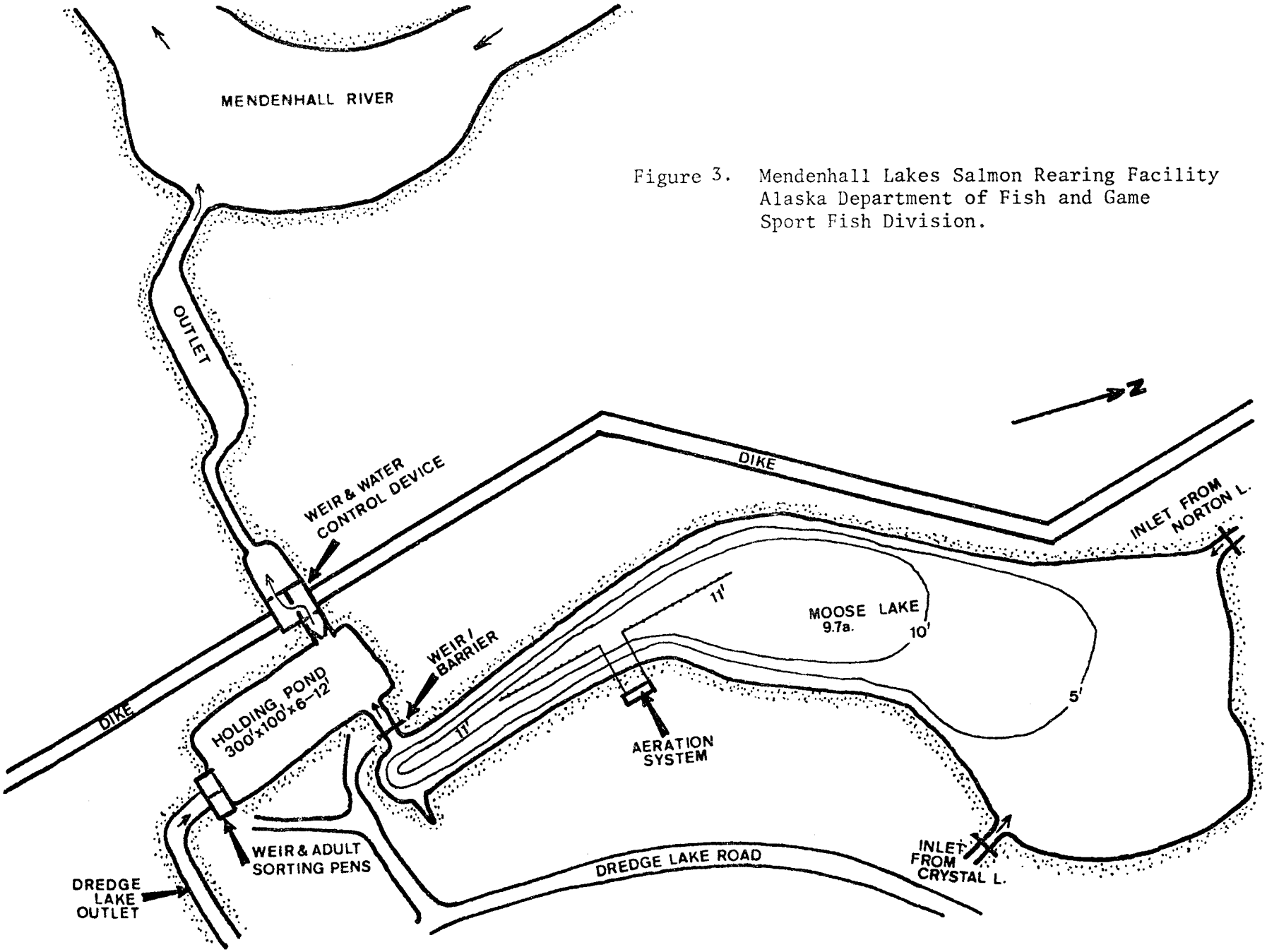



Figure 3. Mendenhall Lakes Salmon Rearing Facility Alaska Department of Fish and Game Sport Fish Division.

Table 2. Mendenhall Facility chinook salmon release and return data from 1972 brood year chinook released in 1974.

| Brood Year | Date Released | Number Marked | Number Released | Year | Age | Sport Catch | Escapement to Facility | Return per Year | Accum. Return | Accum. Percent Return |
|---|---|---|---|---|---|---|---|---|---|---|
| 1972 | 6/74 | 39,560 | 93,560 | 1974 | 1.0 | 0 | 4 | 4 | 4 | 0.00 |
| 5/23-28/74 = 16.8 g., 108.7 mm | | | | 1975 | 1.1 | 0 | 0 | 0 | 0 | 0.00 |
| | | | | 1976 | 1.2 | 32 | 126 | 158 | 162 | 0.17 |
| (Hatched at Crystal Lake Hatchery, reared to smolt at Moose Lake. Marked with Adipose Clip). | | | | 1977 | 1.3 | 12 | 392 | 404 | 566 | 0.60 |
| | | | | 1978 | 1.4 | 0 | 1 | 1 | 567 | 0.61 |
| | | | | | | 44 | 523 | 567 | | |
| 1972 | 6/74 | 124,309 | 124,309 | 1974 | 1.0 | 0 | 11 | 11 | 11 | 0.00 |
| 4/30 - 5/28/74 = 26.8 g. | | | | 1975 | 1.1 | 0 | 0 | 0 | 11 | 0.00 |
| (Hatched at Crystal Lake Hatchery, reared to smolt at hatchery, released as smolt from Mendenhall Facility. Marked with 1/2 Dorsal Clip). | | | | 1976 | 1.2 | 8 | 58 | 66 | 77 | 0.06 |
| | | | | 1977 | 1.3 | 10 | 97 | 107 | 184 | 0.13 |
| | | | | 1978 | 1.4 | 0 | 0 | 0 | 184 | 0.13 |
| TOTAL | | 163,869 | 217,438 | | | 18 | 166 | 184 | | |

1976 33 "strays" counted in Mendenhall River tributaries not included in table.

1977 348 "strays" estimated in Mendenhall River tributaries and two counted in Auke Creek not included in table.

Table 3. Mendenhall Faciltiy coho salmon release and return data from five brood year.

| BROOD YEAR / STOCK | PLANT SITE | DATE | NUMBER STOCKED | NUMBER RELEASED | NON-SMOLTS | SMOLTS | RELEASE DATE | NUMBER MARKED | MARK | JACK RETURNS SF | JACK RETURNS CF | JACK RETURNS FAC | ADULT RETURNS SF * | ADULT RETURNS CF ** | ADULT RETURNS FAC *** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1972 | | | | | | | | | | 1974 | | | 1975 | | |
| Blind Slough | Norton | 8/7/73 | 120,848 | 80,960 | 25,970 | : 54,990 | | | Ad | | | | | | |
| Blind Slough | Dredge | 8/7/73 | 48,896 | 35,555 | 9,120 | : 26,435 | 5/4 to 7/3/74 | 24,485 | Ad | | | | | | |
| Mendenhall (Moose Lake) | Dredge | 8/7/73 | 90,000 | | | | | | Ad | | | | | | |
| | | | 259,744 | 116,515 | 35,090 | 81,425 | | 24,485 | | 0 | 0 | 614 | 333 | 901 | 6,774 |
| | | | | | | | | | | 1975 Mendenhall Facility Egg Take 1,100,000 | | | | | |
| 1973 | | | | | | | | | | 1975 | | | 1976 | | |
| Blind Slough | Moose | 9/17/74 | 99,985 | | | | | | | | | | | | |
| Moose Lake | Moose | 9/--/74 | 109,500 | | | | | | | | | | | | |
| | | | 209,485 | 10,167 | 6,263 | : 3,904 | 5/10/75 | 1,296 | RV | 4 | **** | 11 | 0 | **** | 44 |
| Blind Slough | Holding Pond | (Crystal Lake Hatchery reared) | | | | 50,200 | 5/23 to 6,6,75 | 15,200 | Ad+ 4-2-6 | 18 | 0 | 576 | 89 | 1,064 | 38 |
| Blind Slough | Holding Pond | (Crystal Lake Hatchery reared) | | | | 46,479 | 5/23 to 6/6/75 | 46,479 | Ad+ 1/2 D | 9 | **** | 114 | 0 | **** | 54 |
| | | | | | | 100,583 | | 62,975 | | 31 | 0 | 701 | 89 | 1,073 | 3,501 |
| | | | | | | | | | | | | | | | ***** |
| | | | | | | | | | | 1976 Mendenhall Facility Egg Take 1,008,000 | | | | | |

Table 3. (Cont.) Mendenhall Facility coho salmon release and return data from five brood years.

| BROOD YEAR / STOCK | PLANT SITE | DATE | NUMBER STOCKED | NUMBER RELEASED | NON-SMOLTS | SMOLTS | RELEASE DATE | NUMBER MARKED | MARK | JACK RETURNS SF | JACK RETURNS CF | JACK RETURNS FAC | ADULT RETURNS SF * | ADULT RETURNS CF ** | ADULT RETURNS FAC *** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1974 | | | | | | | | | | 1976 | | | 1977 | | |
| Moose Lake | Moose | 6/75 | 134,500 | | | 38,694 | 5/76 | 14,180 | Ad 4-4-2 | 0 | 0 | 253 | 2 | 658 | 575 |
| North Pen | Moose | 6/75 | 10,000 | | | 4,233 | 5/76 | 4,233 | Ad 4-4-4 | 0 | 0 | 3 | 0 | 4 | 12 |
| South Pen | Moose | 6/75 | 5,000 | | | 2,430 | 4/76 | 2,430 | Ad 4-4-3 | 0 | 0 | 0 | 0 | 5 | 8 |
| Blind Slough | Holding Pond | (Crystal Lake Hatchery reared) | | | | 42,231 | 6/76 | 14,695 | Ad 4-4-14 | 0 | 0 | 141 | 0 | 10 | 3 |
| | | | | | | 87,588 | | 35,538 | | 0 | 0 | 397 | 2 | 667 | 598 |
| | | | | | | | | | | 1977 Mendenhall Facility Egg Take | | | | | |
| | | | | | | | | | | 950,000 | | | | | |
| 1975 | | | | | | | | | | 1977 | | | 1978 | | |
| Moose Lake | | 6/76 | 545,000 | 99,439 | | 99,439 (Transferred to Fish Creek Facility) | | | | | | | | | |
| C.L. Hatchery | Holding Pond | | | | | 22,816 | 5/77 | 22,816 | Ad 4-16-40 | 0 | 1 | 40 | 0 | 47 | 3 |
| Fish Creek Facility | Holding Pond | | | | | 10,097 | 4/77 | 10,097 | Ad 4-2-7 | 1 | 0 | 22 | 0 | 6 | 12 |
| Moose Lake | Moose | | | | | 6,197 | 4/77 | 6,197 | Ad 4-16-42 | 1 | 0 | 65 | 3 | 31 | 10 |
| | | | | | | 39,110 | | 39,110 | | 2 | 1 | 127 | 3 | 84 | 65 |
| | | | | | | | | | | 1978 Mendenhall Facility Egg Take | | | | | |
| | | | | | | | | | | 0 | | | | | |

Table 3. (Cont.) Mendenhall Facility coho salmon release and return data from five brood years.

| BROOD YEAR / STOCK | PLANT SITE | DATE | NUMBER STOCKED | NUMBER RELEASED | NON-SMOLTS | SMOLTS | RELEASE DATE | NUMBER MARKED | MARK | JACK RETURNS SF | JACK RETURNS CF | JACK RETURNS FAC | ADULT RETURNS SF * | ADULT RETURNS CF ** | ADULT RETURNS FAC *** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1976 | | | | | | | | | | 1978 | | | 1979 | | |
| Moose Lake | Holding Pond | 5/3/78 | | | | 10,565 | 5/3/78 | 10,565 | Ad 4-18-54 | 0 | 0 | 0 | 0 | 16 | 6 |
| (Fingerlings overwinter at Fish Creek Facility) | | | | | | | | | | | | | | | |
| Blind Slough | | 5/3/78 | | | | 68,034 | 5/3/78 | 10,024 | Ad 4-18-14 | 0 | 0 | 7 | 14 | 455 | 183 |
| | | | | | | 78,599 | | 20,589 | | 0 | 0 | 62 | 14 | 471 | 422 |

* Calculated sport fish catch which includes Golden North Salmon Derby

** Commercial fishing catch expanded for sampling coverage.

*** Rearing facility returns. Totals include unmarked fish.

**** These marks not looked for in commercial sampling.

***** Includes 3,365 unmarked adults (assumed to be differential marking mortality).

require replacement and the lake would have to be sculptured to facilitate seining. At Norton Lake there was insufficient flow from the outlet to attract salmon smolts and the lake was unsuitable for seining. Further use of Norton Lake would require sculpturing and modification of the outlet channel. The flow from Moose Lake, where the original outlet structure was situated, was also inadequate to attract salmon smolts. However, access around the lake was good and the lake could be seined after lowering the water level. It was decided to reduce the scope of the rearing facility and to determine its usefulness through the rearing of fish in Moose Lake only. If the project was determined to be viable and monies were available, Norton and Dredge Lakes would be put into production.

In May of 1974, a total of 81,425 coho smolts were released from Norton and Dredge Lakes, and 93,1560 chinook salmon smolts were released from Moose Lake, and 124,309 chinook smolts from Crystal Lake Hatchery were released as a control. Smolts were produced from 45.5% of the coho fry planted in Norton Lake and 60.9% of the chinook fry planted in Moose Lake. Dredge Lake could not be evaluated because of unknown fish losses during washouts (Bethers, 1975).

Moose Lake was restocked with rearing coho on September 16, 1974. These fish were of two different sizes, 109,500 at 83 kg (183/lb) and 99,985 at 36.3 kg (80/lb) and averaged 57.6 kg (127/lb) after 2 days mixing in the lake. In May, 1975, only 10,167 coho were found surviving in Moose Lake. The low survival could have been due to stress-related disease and/or added predation due in part to the increased stocking densities. No significant overwinter aeration failures occurred.

During 1975, studies were designed to compare growth and survival of coho reared in Moose Lake with coho reared in freshwater pens, and to compare adult returns from pond-reared smolts with returns from hatchery-reared smolts imprinted to the Mendenhall Facility (Bethers, 1976). It was determined that fish growth in Moose Lake was greater in pens than in Moose Lake.

In 1976 it was suggested that Moose Lake could best be used for freshwater rearing of coho fry destined for the Fish Creek Saltwater Rearing Facility. By using Moose Lake as a freshwater "prepping" station for fish destined for the saltwater facility, it was hoped that the maximum number of locally reared coho smolts could be released for the fisheries. In 1976, 545,000 coho fry were planted in Moose Lake and in late summer, 99,439 of these were seined and transferred to the Fish Creek Estuarine Rearing Facility for overwinter rearing (Bethers, 1977).

In 1977, 10,097 smolts from this group of fish were marked and returned to the Mendenhall Facility for imprinting. A similar group of 22,816 Crystal Lake Hatchery smolts were imprinted, and a remaining 6,197 Moose Lake reared smolts were used as a control.

Adult returns of coho and king salmon have been recorded at the Mendenhall Facility, from strays in spawning streams in the Mendenhall River system and from marked fish recovered in the local sport and commercial fishery sampling. Total adults coho salmon returns (excluding jacks) were calculated to be 8,008 in 1975, 4,663 in 1976, 1,277 in 1977 and 152 in 1978.

The contribution of jacks and adults to the local sport fishery has not been significant due to a combination of late returns, non-biting fish, and glacial conditions in Mendenhall River, which preclude a freshwater fishery. Total adult chinook salmon returns from the 1974 release of king salmon have been 1,131 fish, which includes 381 strays to other tributaries of Mendenhall River, (but does not include recoveries in the commercial fishery). Contribution to the local sport fishery has not been significant, being a calculated 40 fish in 1976 and 22 fish in 1977.

In 1977 this project reviewed data from the Department's Coho Research project, which had inspected approximately 62,100 commercially caught coho (55% of the Juneau area troll catch). A total of 71 coho were recovered from one wild stock (Auke Lake) and from Mendenhall Lakes and Fish Creek rearing facilities. Data collected in 1977 indicated that Mendenhall stock coho released from the Mendenhall Facility was the earliest of the three stocks to enter the Juneau area, while the Auke Lake stock was the latest (Bethers, 1978).

Selection of a potential brood stock in 1978 was derived using catch data evaluating coded wire tagged coho from 16 separate wild stocks. As in 1977, Moose Lake reared coho were the most desirable for Mendenhall Facility release, while Auke Lake reared coho contributed heaviest to the sport fishery but had the latest returns. The Speel Lake returns were selected as the most desirable wild stock, based on the very early returns, heaviest contribution to the commercial troll fishery and potential early return to the Juneau Area sport fishery (Marriott 1979).

## RECOMMENDATIONS

### Management

1. The Mendenhall Facility study should be terminated.

2. The Moose Lake and Dredge Lake portions of the facility should be left open to natural spawning and rearing of coho salmon, and the area should be developed by the U.S. Forest Service as a fish spawning observational and educational site.

3. Drop structures should be left in the Moose Lake tributaries so that Norton, Crystal, Morraine and Glacier Lakes can be maintained for cutthroat trout sport fisheries.

4. Future hatchery enhancement of local coho sport fisheries should target the contribution toward clear-water fresh-water fisheries using the earliest possible coho stocks.

### Research

1. Speel Lake coho stocks should be used as the most desirable brood stock for the local sport and commercial fisheries.

2. For best marine returns, coho fingerlings should be marked and then reared at least 6 months in low densities at the release site prior to outmigrating as smolts.

## TECHNIQUES USED

In 1979, no enumeration or marking was conducted for naturally-reared Moose Lake coho smolts. These fish were allowed to out-migrate on their own volition.

Contribution of past releases from the Mendenhall Facility to the sport and commercial fisheries was determined from data collected by two other State projects. The Department's Commercial Fisheries tag recovery program was used to recover marked fish from the Southeast Alaska commercial troll catch (Davis, 1978). Juneau creel census conducted under Sport Fish Harvest Studies was used to recover marked fish from the Juneau area saltwater sport catch (Robards, 1976, 1977, 1978, Marriott and Jones, 1979).

Nearly full coverage occurred for fish entered in the Golden North Salmon Derby, with nearly all of the validated fishermen being checked for fish taken home. Marked fish recoveries during the regular survey were expanded for coverage; whereas, voluntary, supplemental and derby recovered marks were added to the total but not expanded.

An inmigrant trap was maintained in the outlet of the holding pond to capture adult salmon returning to the facility. This trap was checked daily during the period of returns. Adipose marked adults were killed, length measurements and scale samples taken, and the heads returned to the lab for tag removal. Unmarked salmon and jacks were allowed access to the spawning and rearing areas of Moose Lake and Dredge Lake.

## FINDINGS

### 1972 Brood Chinook Returns

The main outlet structure trap was operated all year in 1979, but caught no 1.5 age chinook from the 1972 brood year rearing. No returns of this mark appeared in the commercial or sport fishery and no chinook strays were observed within the Mendenhall River watershed.

### 1976 Brood Coho Returns

Returns of 1976 brood year coho appeared as jacks (precocious males) in 1978 and as adults in 1979. Of the 10,565 Moose Lake-reared, Fish Creek Facility-overwintered smolts released at the Mendenhall Facility on May 3, 1978, no jacks returned in 1978 and none were detected as strays or in the sport or commercial fishery. Of the 10,024 marked Crystal Lake Hatchery-reared coho (from a total release of 68,034) released on May 3, 1978 at the Mendenhall Facility, a calculated seven returned to the facility and none were detected as strays or in the sport or commercial fishery. The 54 unmarked jacks which returned to the facility in 1978 were assumed to be from the unmarked portion of this release. One additional adipose-clipped jack with no wire tag also returned to the facility in 1978 and was included in the unmarked lot.

The commercial sampling conducted in 1979 recovered both marked lots in the troll fishery, mostly from offshore areas 113 and 157, shown in Figure 4. Expanded for sampling coverage, the Fish Creek Facility reared lot contributed 16 coho and the Crystal Lake Hatchery reared lot contributed 67 marked coho, and a calculated 455 coho from the entire release of 68,034 smolts. This contribution compares with 1,064 adults caught from 50,200 smolts of the 1973 brood year, and 658 adults caught from 38,694 smolts of the 1974 brood year, and is much better than the 47 adults caught from 22,816 smolts of the 1975 brood year. The mean date of capture in 1979 for the Fish Creek Facility reared lot was August 15, and for the Crystal Lake Hatchery reared lot was August 18. These dates are similar to the August 20 date of 1978. As fishing dates are to some degree an artifact of seasons and effort shift in different statistical areas, these dates are of limited reliability (Table 4).

The Juneau area sport fishery harvest studies conducted in 1979 recovered no marked Mendenhall Facility returns. Sample coverage was sufficient to interview about 20% of the marine boating anglers. Two voluntary returns from late July and early August were from the Crystal Lake Hatchery-reared lot. These two returns could not be expanded for creel census coverage, but were expanded to 14 fish for the entire 68,034 release contribution (Table 5).

An interesting phenomenon of the 1979 Mendenhall Facility returns was that the early and late segments of the returns differed greatly in their marked: unmarked ratios. During the October 1 - October 15 period, 208, or 86% of the coho could not be accounted for as belonging to the unmarked portion of the Crystal Lake Hatchery-reared lot. This group of fish also consisted of more males than females (62 percent males). After a cold period of low water and no fish, the November 14 - November 28 time period contained a much higher percentage of marks and only 25, or 14 percent, were unaccounted for. It is thought that the early portion of the run contained a large group of coho bound for Mendenhall Lake tributaries, and that these fish were "testing" the Dredge Lake - Moose Lake water source and were unable to leave the system due to the outlet trap. If this explanation were applied to the 1973 brood year returns, it would indicate that the 3,365 unaccounted for unmarked adult returns were not due to "differential mortality" but to straying, and that the 1973 brood year was a failure rather then a success (Table 6).

Brood Stock Evaluation

Parameters being examined for an improved brood stock for the Juneau area include: (1) early entry and long availability in the Juneau area, (2) high smolt-to-adult survival, (3) high contribution to the sport and troll fisheries by remaining in a "biting condition", (4) early return and maturation at the facility, (5) a low incidence of straying, and (6) a low incidence of precocious males.

The 1979 evaluation of a potential brood stock was from data collected on coded-wire tagged salmon through the Juneau marine creel census and Division of Commercial Fisheries sampling programs (Tables 4,5, and 7). Stocks evaluated besides the Mendenhall releases, were 14 releases from the Fish Creek Facility, 6 lots of Taku River, 2 lots of Chilkoot Lake, 6 lots

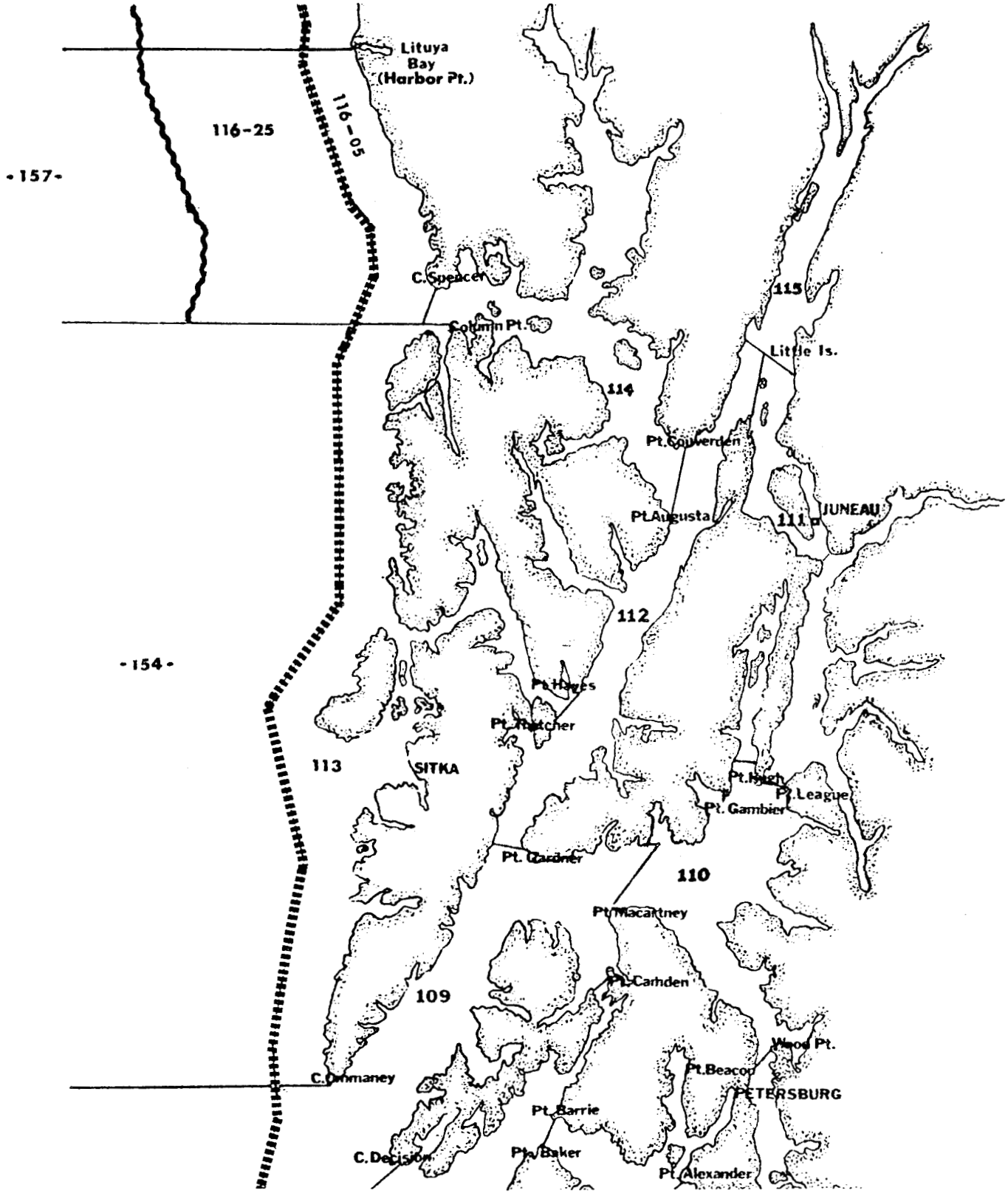



Figure 4. Commercial fishing sections of northern Southeast Alaska.

Table 4. Sport and Commercial Recoveries of Selected Coded Wire Tagged Stocks of Coho Salmon from the Juneau Area, 1979.

| Stock (Release Site) (CWT Code) | Number Smolts Tagged | Sport Catch | Commercial Troll Recoveries by Area * | | | | | | | | Contribution Index (Catch/smolts release) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 157 | 116 | 115 | 114 | 113 | 112 | 111 | Other | |
| Crystal Lake Hatchery (Mendenhall Facility) (11-18-14) | 10,024 | 2 | 20 | 11 | 9 | 2 | 19 | 0 | 3 | 3 | 0.007 |
| | | | TOT 67 | | | | | | | | |
| Fish Creek Pens (Mendenhall Facility) (11-18-54) | 10,565 | 0 | 4 | 6 | 0 | 2 | 4 | 0 | 0 | 0 | 0.002 |
| | | | TOT 16 | | | | | | | | |
| Fish Creek Pens (Fritz Cove) (14 lots) | 139,563 | 72 | TOT 187 | | | | | | | | 0.002 |
| Taku R. & Tribs. (Fingerling marking) (6 lots) | 19,211 | 18 | TOT 201 | | | | | | | | 0.011 |
| Speel Lake (Fingerling marking) (4-16-48) | 5,358 | 5 | TOT 173 | | | | | | | | 0.033 |
| Crescent Lake (Fingerling marking) (4-16-47, 4-16-36) | 6,165 | 5 | TOT 54 | | | | | | | | 0.010 |
| Berners River (Fingerling marking) (4-17-29, 4-16-37) | 11,138 | 8 | TOT 283 | | | | | | | | 0.026 |

* Expanded for sample coverage.

Table 5. Tag Codes and Numbers of Cohos Released From Local Facilities, Expected for Return in 1979.

| Facility | Date Release | Fin Clip/ Binary Code | Marked Fish In Release Group | Total Release | Tags + Recovered | EST. * Total Caught |
|---|---|---|---|---|---|---|
| Mendenhall | 5/03/78 | AD/4-18-14 | 10,124 | 68,034 | 2 | |
| Mendenhall | 5/03/78 | AD/4-18-54 | 10,565 | | | |
| Fish Creek | 5/18/78 | AD/4-18-24 | 17,765 | 18,239 | 2 | 8 |
| Fish Creek | 5/18/78 | AD/4-16-3 | 16,046 | 16,749 | 5 | 14 |
| Fish Creek | 5/18/78 | AD/4-18-55 | 9,281 | 9,470 | 2 | 4 |
| Fish Creek | 5/18/78 | AD/4-18-56 | 9,338 | 9,529 | | |
| Fish Creek | 5/18/78 | AD/4-18-57 | 10,074 | 10,135 | | |
| Fish Creek | 5/18/78 | AD/4-18-11 | 9,827 | 10,048 | 1 | |
| Fish Creek | 5/18/78 | AD/4-18-12 | 9,531 | 9,745 | 4 | 28 |
| Fish Creek | 5/18/78 | AD/4-18-13 | 9,644 | 9,901 | 2 | 6 |
| Fish Creek | 5/18/78 | NONE | NONE | 40,034 | | |
| Fish Creek | 5/18/78 | NONE | NONE | 33,945 | | |
| Fish Creek | 7/19/78 | AD/4-18-15 | 10,009 | 10,172 | | |
| Fish Creek | 7/19/78 | AD/4-18-21 | 4,927 | 4,972 | | |
| Fish Creek | 7/19/78 | AD/4-18-6 | 5,275 | 5,506 | 2 | 12 |
| Fish Creek | 7/19/78 | AD/4-18-32 | 8,694 | 9,902 | | |
| Fish Creek | 7/19/78 | AD/4-18-33 | 9,585 | 9,881 | | |
| Fish Creek | 7/19/78 | AD/4-18-21 | 9,567 | 9,832 | | |
| TOTAL RELEASED | | | 160,152 | 296,659 | 20 | 72 |

\+ Tags recovered included all tags recovered from creel sampling, voluntary returns and Derby interceptions

* Estimates of total marked fish cuaght based on recoveries from creel sampling only.

Estimated total contribution of marked and unmarked released fish to sport fishery: 140 coho

Table 6. Coho Salmon Returns to the Mendenhall Facility in 1979.

| Time Period | Observed | | | Corrected for Missing tags and Expanded for % of lot marked | | | | |
|---|---|---|---|---|---|---|---|---|
| | Unmarked | 4-18-14 | 4-18-54 | Unaccounted | 4-18-14 | 4-18-54 | Total | Sex Ratio M:F |
| 10/1 - 10/15 | 237 | 5 | 1 | 208 | 34 | 1 | 243 | 62:38 |
| 11/14 - 11/28 Late | 152 | 19 | 4 | 25 | 149 | 5 | 179 | 48:52 |
| | 389 | 24 | 5 | 233 | 183 | 6 | 422 | |

of Chilkat River, 2 lots of Berners River, 1 lot of Speel Lake, and 2 lots of Crescent Lake wild coho. A total of 160,152 facility-reared smolts and 60,034 wild-system fingerlings were tagged for these studies.

These fish were marked primarily to assess the commercial fishery harvest rates in Icy Straits and offshore waters, but marked returns passing through the Juneau sport fishery could be examined for contribution to that fishery and mean date of capture. Since accurate spawning ground estimates were not available for all stocks, particularly the Fish Creek returns which strayed to many small systems, the best index of desirable brood stock was adult catch (Sport and Commercial) per smolt. The wild stocks marked as fingerlings could be expected to have index values about half those of facility fish, due to approximately 6 additional months of over-winter mortality and some retention, (outmigrating as 3-check smolts). On the other hand, the wild smolts were one year older at the time of smolt-ification, a potentially compensating factor. As seen in Table 4, Contribution Index, the Crystal Lake Hatchery reared lot performed 3.5 times better than the Fish Creek reared lots, probably because of larger smolt size and higher condition level of the smolts. However, the Fish Creek reared lots performed better in the marine sport fishery, which actively fished the return site and caught a calculated 72 of the Fish Creek cohos. The wild stocks performed better in both the sport and commercial fisheries, and highest among these was the Speel Lake stock.

This stock also performed best in 1978, and was available to the Juneau area sport fishery over the longest period of time. Although presenting some egg-take problems in the holding of spawners, this stock is closest to the new Snettisham hatchery and has been selected as the primary coho brood stock for this facility.

## DISCUSSION

The 1979 return data continues to demonstrate the lowered smolt-to-adult survivals being experienced by all rearing facilities in the area working with coho salmon.

Coho smolt-to-adult return ratios observed in most natural systems are normally at least 10%, and this percentage is the accepted standard in coho predictions. The 1972 brood year coho demonstrated a 9.83% survival rate, but this rate has progressively declined to 4.64%, 1.36%, 0.28% and 0.86% in a tangent curve approaching 0.0% (Fig. 5).

This alarming trend has also been observed at the Department's Fish Creek Estuarine Rearing Facility, Starrigavan Estuarine Rearing Facility and the Blind Slough run at the Crystal Lake Hatchery.

Bacterial Kidney Disease (BKD) has appeared in tissue samples of smolts from all brood years when eggs were incubated at the Crystal Lake Hatchery, and the one factor in common with all of these facilities is the incubation of eggs at this hatchery, followed by high-density rearing. It appears that this chronic infection began in the closed recirculating system of this hatchery and has produced stress-related mortalities throughout the life of each brood class that has been exposed.

Table 7. Tag Codes of Wild Cohos Expected to Return Through The Juneau Sport Harvest Area In 1979.

| Area | Code | # Tagged | Tags Recovered | Est.Total Tags | Est. Stock Cont. |
|---|---|---|---|---|---|
| Main Taku River | 4-16-29 | 1,958 | | | |
| Moose Lake | 4-16-19 | 5,035 | 1 | 4 | 730 |
| Moose Lake | 4-16-21 | 2,622 | 1 | 6 | |
| Moose Lake | 4-16-22 | 88 | | | |
| Sockeye Creek | 4-16-45 | 4,450 | 3 | 8 | |
| Yehring Creek | 4-16-18 | 5,058 | | | |
| Total Taku | | 19,211 | | | |
| Chilkoot Lake | 4-16-23 | 2,545 | | | |
| | 4-16-24 | 539 | | | |
| Total Chilkoot | | 3,084 | | | |
| Chilkat Ponds | 4-16-28 | 1,987 | | | |
| | 4-16-27 | 742 | | | |
| Airport Ponds | 4-16-20 | 4,060 | | | |
| Mosquito Lake | 4-16-46 | 5,741 | 1 | --- | |
| | 4-16-26 | 246 | | | |
| Chilkat Lake | 4-16-25 | 2,284 | | | |
| Total Chilkat | | 15,078 | | | |
| Berners River | 4-17-29 | 10,758 | 1 | 8 | 144 |
| | 4-16-37 | 380 | | | |
| Total Berners | | 11,138 | | | |
| Speel Lake | 4-16-48 | 5,358 | 4 | 5 | 69 |
| Crescent Lake | 4-16-47 | 5,825 | 1 | 5 | 284 |
| | 4-16-36 | 340 | | | |
| Total Crescent | | 6,165 | | | |

FIGURE 5. SMOLT:ADULT SURVIVAL RATES FOR 5 BROOD YEARS OF COHO RETURNING TO THE MENDENHALL FACILITY.

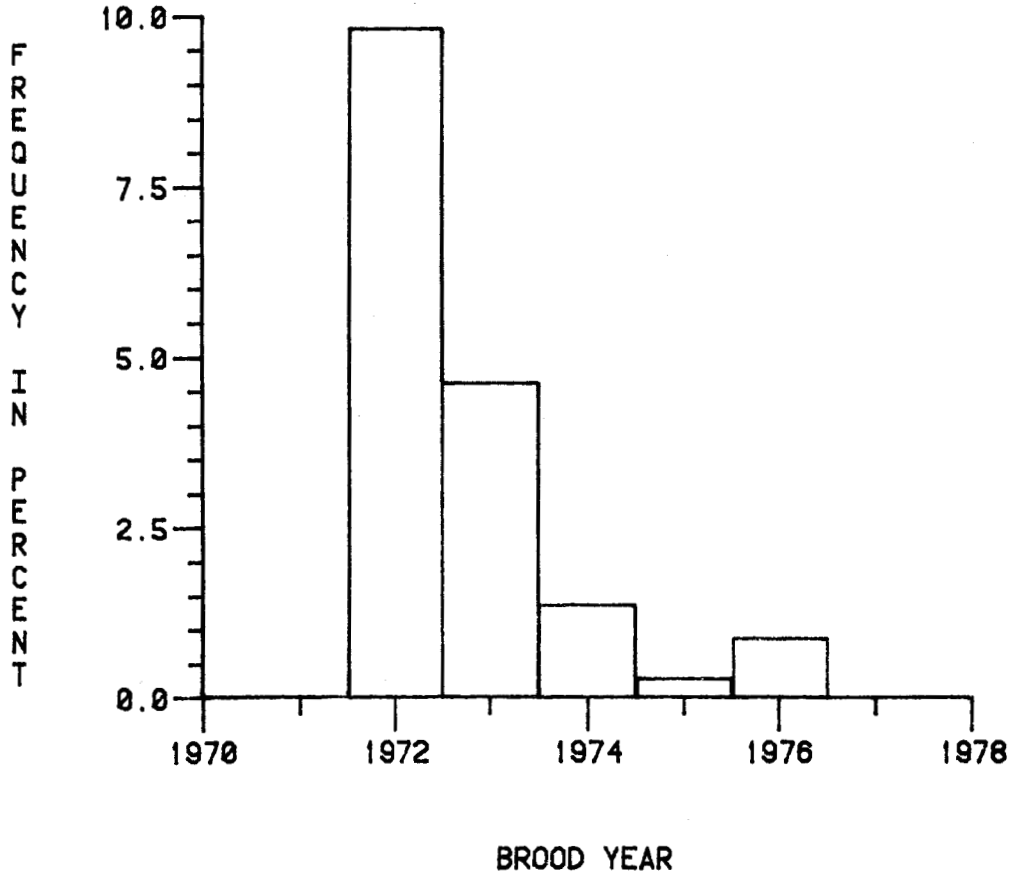
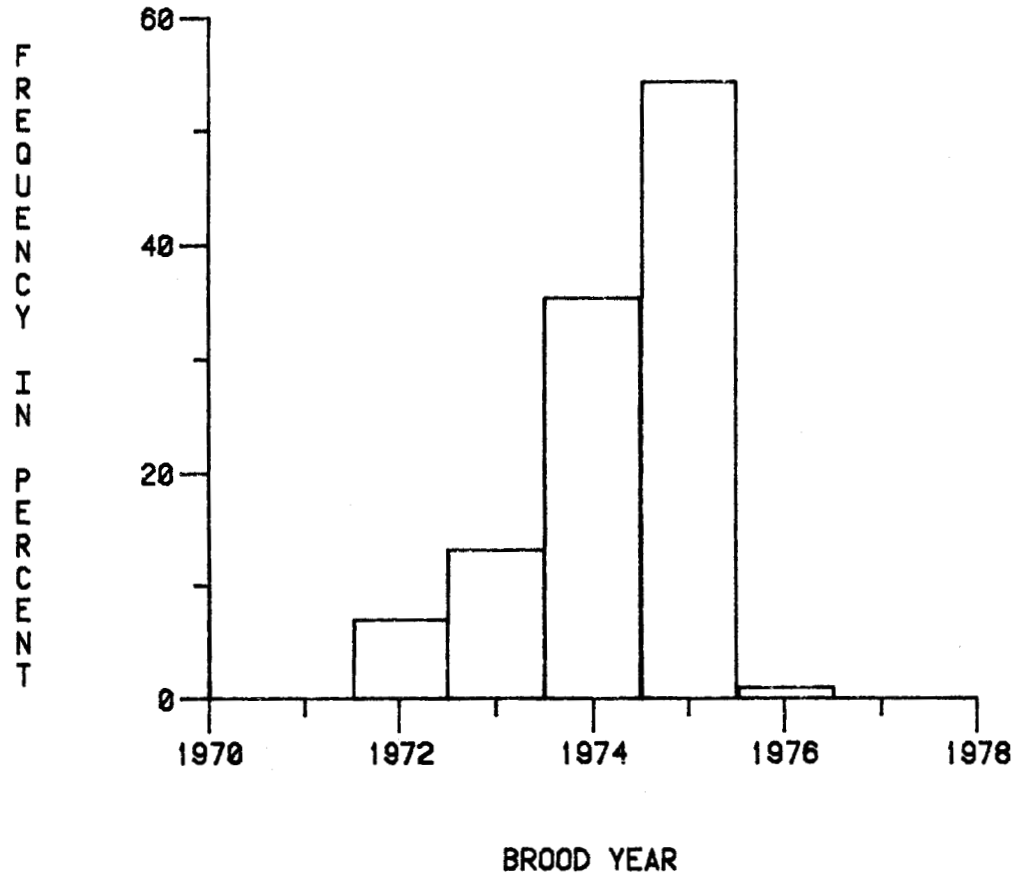


FIGURE 6. PERCENTAGE OF JACKS IN MENDENHALL FACILITY COHO RETURNS.



The Fish Creek Facility and Starrigavan Facility are being phased out and the Crystal Lake Hatchery was temporarily closed down in early 1978 for sterilization. The excellent 1979 returns were screened and sorted during egg-takes through microscopic examination, and only disease-free eggs were incubated in the facility.

At this time it appears that development of a better brood stock and less crowding (in both the hatchery and rearing areas) will increase smolt-to-adult survival, and the 1976 brood year was encouraging in the unusually low incidence of jacks, as shown in Figure 6.

If the Mendenhall Facility was located on a clear water system and experienced returns similar to the 8,000+ adult coho that returned in 1975, a freshwater sport fishery could be developed within the migration route to the faciltiy. Even under these conditions, the returning fish would normally enter the river during periods of heavy rain and flooding conditions, and it is doubtful that more than 1,000 could be legally harvested before they would become too mature to be attractive sport fish. One approach being considered by the FRED Division is the selection of an early returning stock, hatchery incubation to fry stage, and low-density stocking into scattered non-anadromous lakes for rearing under natural conditions. This method will probably create improved smolt-to-adult survival; however, the effects of mixing genetic stocks, effects on natural runs below the lakes, and the general economic viability of this approach have yet to be demonstrated.

In the meantime, the best use of the Mendenhall Facility appears to be maintaining the natural run of coho salmon (and possible adding a stock of sockeye salmon) and modifying the area to capitalize on its values as an educational spawning area attraction.

LITERATURE CITED

Bethers, M. R. 1974. Mendenhall Lakes Salmon Rearing Facility. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1973-1974, Project F-9-6, 15 AFS (43-4). 23 pp.

_____. 1975. Mendenhall Lakes Salmon Rearing Facility. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1974-1975, Project F-9-7, 17(AFS 43-5). 15 pp.

_____. 1976. Mendenhall Lakes Salmon Rearing Facility. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1975-1976, Project F-9-8, 17(AFS 43-4). 15 pp.

_____. 1977. Mendenhall Lakes Salmon Rearing Facility. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1976-1977, Project F-9-9, 18(AFS 43-5). 32 pp.

_____. 1978. Mendenhall Lakes Salmon Rearing Facility. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1977-1978, Project F-9-10, 19(AFS 43-6). 43 pp.

Davis, A. 1978. Southeastern Alaska commercial troll fishery. Alaska Department of Fish and Game Technical Data Report No. 32, 1977.

Robards, F. S. 1976. Inventory and Cataloging of the sport fish and sport fish waters in Southeast Alaska. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1975-1976, Project F-9-8, 17(G-I-Q). 99-106.

_____. 1977. Harvest estimates of selected fisheries throughout Southeast Alaska. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1976-1977, Project F-9-9, 18(G-I-Q). 41 pp.

_____. 1978. Harvest estimates of selected fisheries throughout Southeast Alaska. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1977-1978, Project F-9-10, 19(G-I-Q). 48 pp.

Marriott, R. A. and D. E. Jones. 1979. Harvest estimates of selected fisheries throughout Southeast Alaska. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1978-1979, Project F-9-11, 20(G-I-Q).

Marriott, Richard A. 1979. Mendenhall Lakes Salmon Rearing Facility. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1978-1979, Project F-9-11, 20(AFS 43-7) 24 pp.

Schwan, Mark W. 1980. Harvest Estimates of Selected Fisheries throughout Southeast Alaska. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1979-1980, Project F-9-12, 21 (G-I-QB). In press.

Prepared by:

Richard A. Marriott
Fishery Biologist

Approved by:

Rupert E. Andrews, Director
Sport Fish Division

Mark C. Warner, Ph.D.
Sport Fish Research Chief